Regency® COMMUNICATIONS INC.

SERVICE MANUAL

ADJUSTABLE TONE SQUELCH (CTCSS) SYSTEM

MODEL MA-116

1227 S.PATRICK DR.
SATELLITE BEACH, FLA.

7001-4008-000

PRINTED IN U.S.A.
1-80

INDEX

I. MA-116 INSTALLATION INSTRUCTIONS (CTCSS Field Installation Kit)

A. General

B. Installation Instructions for MICRO-COM U11, U12, U14, U11H, U12H, U14H, U01, U04

C. Installation Instructions for MICRO-COM U11B, U14B

D. Installation Instructions for BTH-201B

E. Addendum to Installation Instructions

II. MA-116 TONE SQUELCH (CTCSS) OPTION

A. General Description

B. Circuit Description (Tone Receiving Condition)

C. Transmitting and Monitoring Condition

D. Tone Setting Instructions

E. Install Jumpers for the Proper Band

F. Tone Setting Precautions

G. Block Diagram (Fig. 6)

H. Schematic (Fig. 7)

I. Parts Placement, Parts Overlay (Fig. 8)

J. Parts List

III. MA-116 ADDENDUM MANUAL (P.C. Board, Rev. C)

A. General

B. Installation

C. Adjustment

D. Schematic

E. Parts Placement

F. Parts Overlay

G. Parts List

INSTALLATION INSTRUCTIONS

CTCSS FIELD INSTALLATION KIT

WARNING! TAKE CARE TO INSTALL THE TONE BOARD PROPERLY. REFER TO EITHER FIG. 1, 2 or 3 FOR PROPER ORIENTATION.

A. GENERAL

This kit consists of a single circuit board intended for installation in the following Regency Transceiver models. In performing this installation, it will be helpful to have the referenced service manuals.

1. MICRO-COM U11, MICRO-COM U12 and MICRO-COM U14 (publication SM-10-843)
2. MICRO-COM U11H, MICRO-COM U12H and MICRO-COM U14H (publication SM-10-843, plus High Band Addendum)
3. MICRO-COM U01 and MICRO-COM U04 (publication SM-10-843, plus Low Power Addendum)
4. MICRO-COM U11B, MICRO0COM U14B (publication SM-40-045)
5. BTH-201B (publication SM-10-388) Note: This CTCSS kit is only applicable on BTH-201B Base Stations produced after October 1975. These can be identified by noting the microphone connector. Those with a five pin connector will accept the MA-116 kit.
6. MICRO-COM U10R (Theory of operation, installation, adjustment, etc. of CTCSS modules in this repeater are discussed in its service manual and in addenda thereto.)

B. INSTALLATION INSTRUCTIONS FOR INSTALLATION IN:

MICRO-COM U11
MICRO-COM U12
MICRO-COM U14
MICRO-COM U11H
MICRO-COM U12H
MICRO-COM U14H
MICRO-COM U01
MICRO-U04

1. Remove the transceiver from its case, and remove the loud-speaker with its brackets.
2. The shield area that accepts the CTCSS module is located in the transmitter portion, toward the front of the radio. The receptacle for the tone board is located in this shielded area. Refer to Figure 1.
3. A shorting jumper will be observed connecting between pins J and L of the tone board receptacle. This jumper is located on the circuit side of the transmitter printed circuit board, close to pins J and L of the tone receptacle. This jumper should be removed. (In radios not equipped with tone squelch the jumper serves the purposes of providing a path for the receiver audio.) Refer to Figure 2.

4. Plug the tone board into the receptacle.
   NOTE: The following instructions assume that the tone board has been adjusted to the proper CTCSS frequency. If this is not so, carry out the adjustments outlined under the "Tone Frequency Setting Adjustments" section before proceeding.

5. Adjustment Procedure (Setting Tone Modulation Deviation)

   Adjust R618, on the tone squelch board to obtain a tone modulation deviation of plus and minus 500 Hz. Then, insert a 100 millivolt, 1,000 Hz tone into pin four of the microphone jack, and adjust R240, (the transmitter deviation control on the transceiver) to obtain plus and minus 5 KHz peak modulation deviation. If R240 was changed much, remove the 1,000 Hz tone, and readjust R618 to obtain a tone squelch modulation deviation of plus and minus 500 Hz.

6. Adjustment Procedure (Setting Tone Receive Threshold)

   With the transceiver in the receive condition, and the microphone hang up button grounded to the transceiver chassis, inject a signal of the appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 250 Hz. Then, adjust R612 (on the tone board) until the signal just opens the tone squelch system, and allows the receiver audio to function.

   After performing this adjustment of R612, check to be sure that the tone squelch will actually open when the tone deviation of the receive signal becomes as much as plus and minus 250 Hz. Further, check to be sure that noise bursts do not come through when the receiver is not receiving any incoming signal.

7. Fasten the loudspeaker back in place, and put the transceiver back in its case.

8. For proper operation of the automatic tone monitoring system, the microphone hang-up hook must be grounded to the vehicle chassis. If the hang-up hook has been mounted on insulating material, run a grounding wire to it.

C. INSTALLATION INSTRUCTIONS FOR INSTALLATION IN:

MICRO-COM U11B
MICRO-COM U14B

1. Remove the transceiver from its case.

2. The shield area that accepts the CTCSS module is located in the transmitter portion, toward the right rear of the radio. The receptacle for the tone board is located in this shielded area. Refer to Figure 3.

3. A shorting jumper will be observed connecting between pins J and L of the tone board receptacle. This jumper is located on the circuit side of the transmitter printed ciruit board, close to pins J and L of the tone receptacle. This jumper should be removed. (In radios not equipped with tone squelch the jumper serves the purpose of providing a path for the receiver audio.) Refer to Figure 4.

4. Plug the tone board into the receptacle.
   NOTE: The following instructions assume that the tone board has been adjusted to the proper CTCSS frequency. If this is not so, carry out the adjustments outlined under the "Tone Frequency Setting Adjustments" section before proceeding.

5. Adjustment Procedure (Setting Tone Modulation Deviation)

   Adjust R618, on the tone squelch board to obtain a tone modulation deviation of plus and minus 500 Hz. Then, insert a 100 millivolt, 1,000 Hz tone into pin four of the microphone jack, and adjust R240, (the transmitter deviation control on the transceiver) to obtain plus and minus 5 KHz peak modulation deviation. If R240 was changed much, remove the 1,000 Hz tone, and readjust R618 to obtain a tone squelch modulation deviation of plus and minus 500 Hz.

6. Adjustment Procedure (Setting Tone Receive Threshold)

   With the transceiver in the receive condition, and the microphone hang up button grounded to the transceiver chassis, inject a signal of the appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 250 Hz. Then, adjust R612 (on the tone board) until the signal just opens the tone squelch system, and allows the receiver audio to function.

   After performing this adjustment of R612, check to be sure that the tone squelch will actually open when the tone deviation of the receive signal becomes as much as plus and minus 250 Hz. Further, check to be sure that noise bursts do not come through when the receiver is not receiving any incoming signal.

7. Put the transceiver back in its case.

8. If the MA-93 desk style microphone is used with the base station, depressing the "monitor" switch segment on the microphone disables the receive tone squelch action, and enables the operator to monitor others on the channel--regardless of whether they have tone squelch. It is considered good radio manners to determine whether the channel is in use, by pushing the monitor button, before transmitting.

   If the MA-83 hand held microphone is used with the base station, the microphone hang up hook must be grounded to the base station chassis. The base station automatically switches to "monitor" when the microphone is lifted from its hang up hook. Operators should be cautioned that the outgoing tone squelch signal will not be transmitted if they attempt to transmit by pushing the mike button, while leaving the microphone in its hang up hook. If this is done, the transmit light will light normally, but the transmissions will not be heard by the mobiles unless they just happen to be in the "monitor" condition.

D. INSTALLATION INSTRUCTIONS FOR INSTALLATION IN:

BTH-201B NOTE: These instructions are for installing the MA-116 in BTH-201B models manufactured after October,1975. These units may be identified by noting the microphone connector. Those with a five pin connector will accept the MA-116 kit.

1. Remove the transceiver from its case.

2. The connector that accepts the tone squelch circuit board is located on the front side of the shield plate which is next to the transmit-receive relay. Refer to Figure 5.

3. A shorting jumper connector will be observed on pins J and L of the tone board receptacle (pins J and L are at one end of the connector). Remove this shorting jumper. In radios not equipped with tone, this jumper serves the purpose of providing a path for the receiver audio.

4. Plug the tone squelch circuit board into the receptacle.
   NOTE: The following instructions assume that the tone board has been adjusted to the proper CTCSS frequency. If this is not so, carry out the adjustments outlined under the "Tone Frequency Setting Adjustments" section before proceeding.

5. Adjustment Procedure (Setting Tone Modulation Deviation)

   Adjust R618, on the tone squelch board to obtain a tone modulation deviation of plus and minus 500 Hz. Then, insert a 100 millivolt, 1,000 Hz tone into pin four of the microphone jack, and adjust R228, the transmitter deviation control to obtain plus and minus 5 KHz peak modulation deviation. If

R228 was changed much, remove the 1,000 Hz tone, and readjust R618 to obtain a tone squelch modulation deviation of plus and minus 500 Hz.

6. Adjustment Procedure (Setting Tone Receive Threshold)

   With the transceiver in the receive condition, and the microphone hang up button grounded to the transceiver chassis, inject a signal of the appropriate channel frequency into the transceiver antenna jack, and modulate this signal with the wanted CTCSS tone frequency, with a deviation of plus and minus 250 Hz. Then, adjust R612 (on the tone board) until the signal just opens the tone squelch system, and allows the receiver audio to function.

7. Put the transceiver back in its case.

8. If the MA-93 desk style microphone is used with the base station, depressing the "monitor" switch segment on the microphone disables the receive tone squelch action, and enables the operator to monitor others on the channel--regardless of whether they have tone squelch. It is considered good radio manners to determine whether the channel is in use, by pushing the monitor button, before transmitting.

   If the MA-83 hand held microphone is used with the base station, the microphone hang up hook must be grounded to the base station chassis. The base station automatically switches to "monitor" when the microphone is lifted from its hang up hook. Operators should be cautioned that the outgoing tone squelch signal will not be transmitted if they attempt to transmit by pushing the mike button, while leaving the microphone in its hang up hook. If this is done, the transmit light will light normally, but the transmissions will not be heard by the mobiles unless they just happen to be in the "monitor" condition.

E. ADDENDUM TO INSTALLATION INSTRUCTIONS #7001-4008-000

MA-116 Installation in the MCU-11B & MCU-14B

Reroute the yellow, blue and white wires to the tone-plug-in area on the transmitter board as shown in Figure A1,(straddling the transmitter/receiver divider rib).

Wire lengths are: yellow, 8 3/4 inches; blue, 8 1/2 inches; white, 9 3/4 inches.

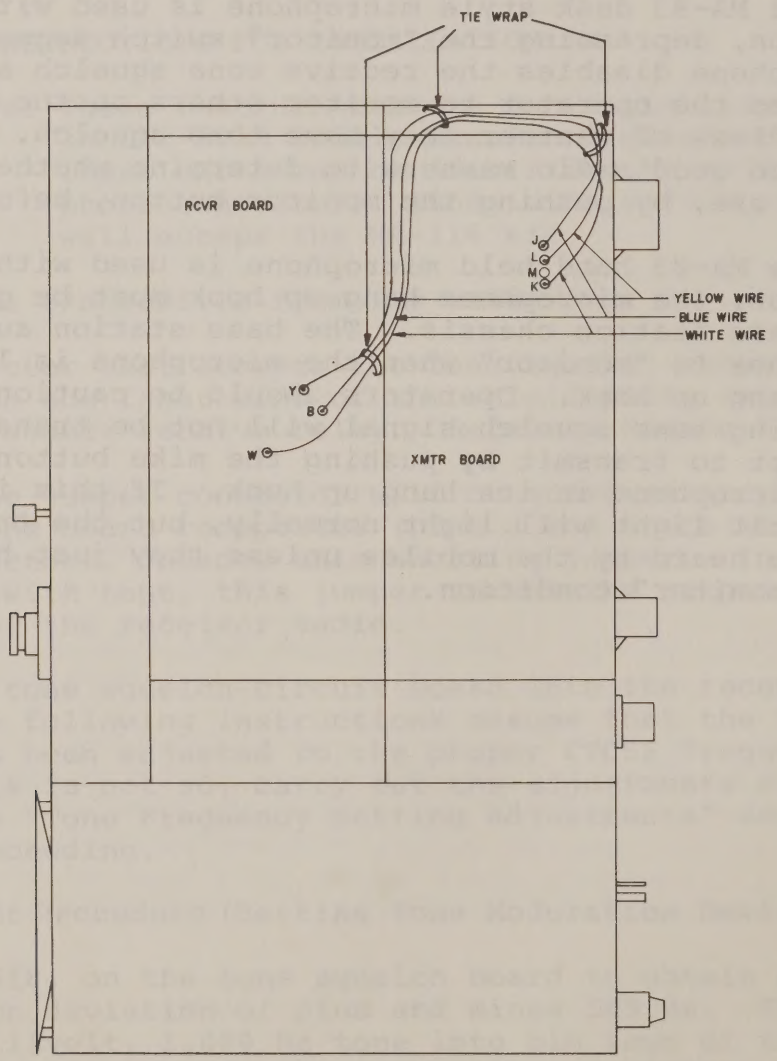


FIG A-1
BOTTOM VIEW; MCU 11B,14B

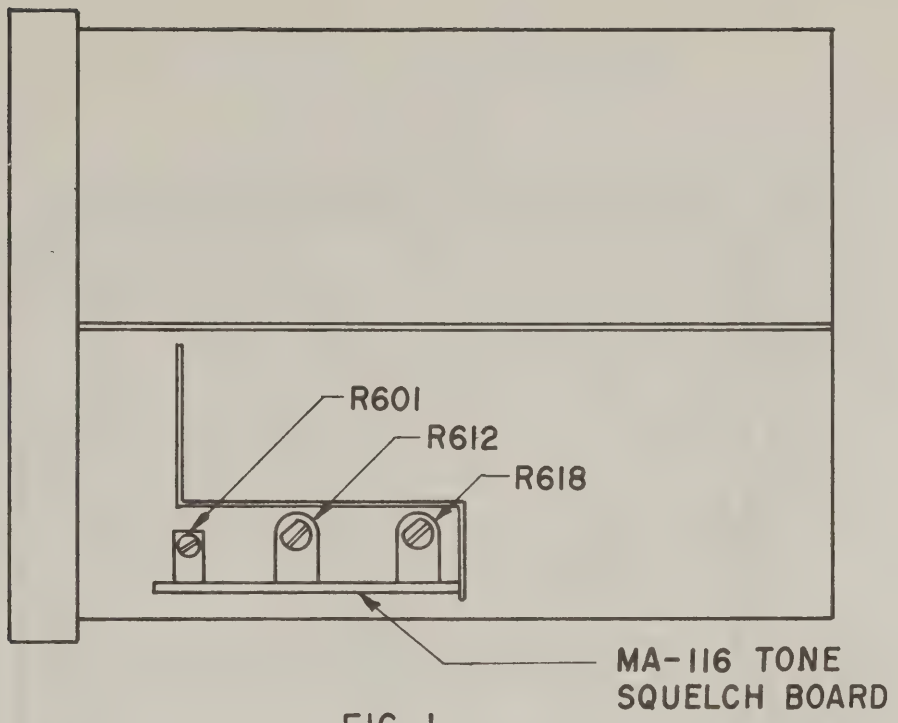

R601
R612
R618
MA-116 TONE
SQUELCH BOARD

FIG 1

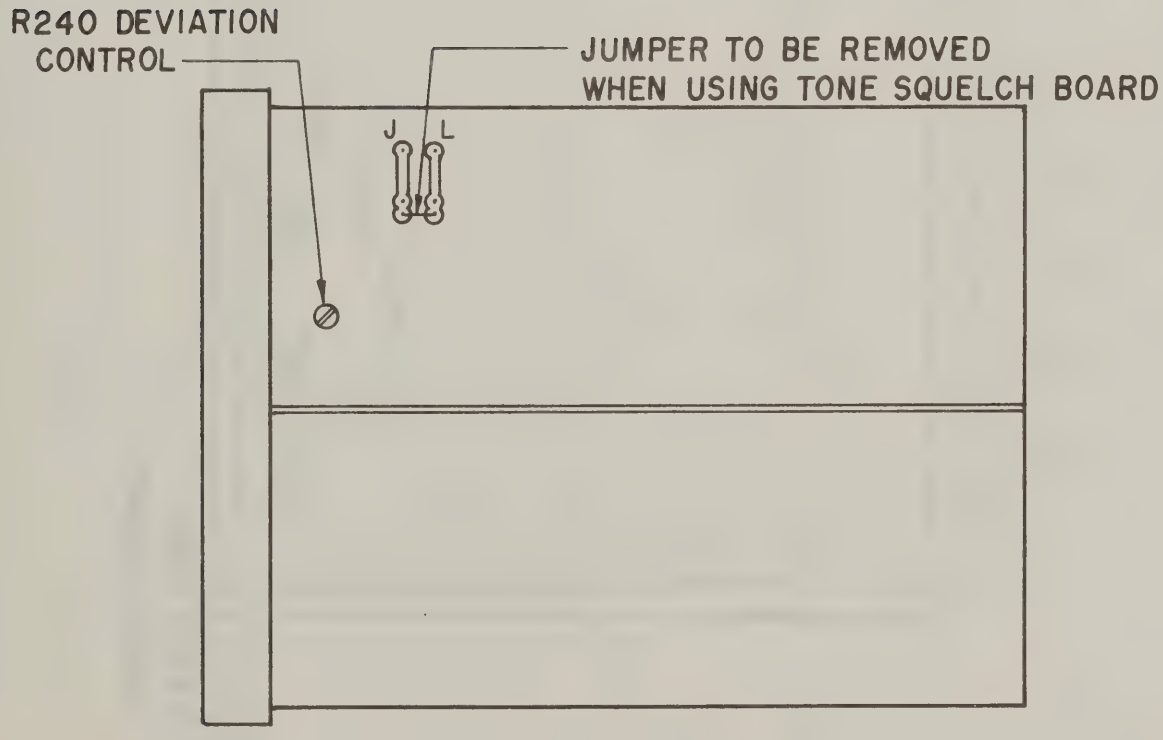

R240 DEVIATION
CONTROL
JUMPER TO BE REMOVED
WHEN USING TONE SQUELCH BOARD
J
L

FIG 2

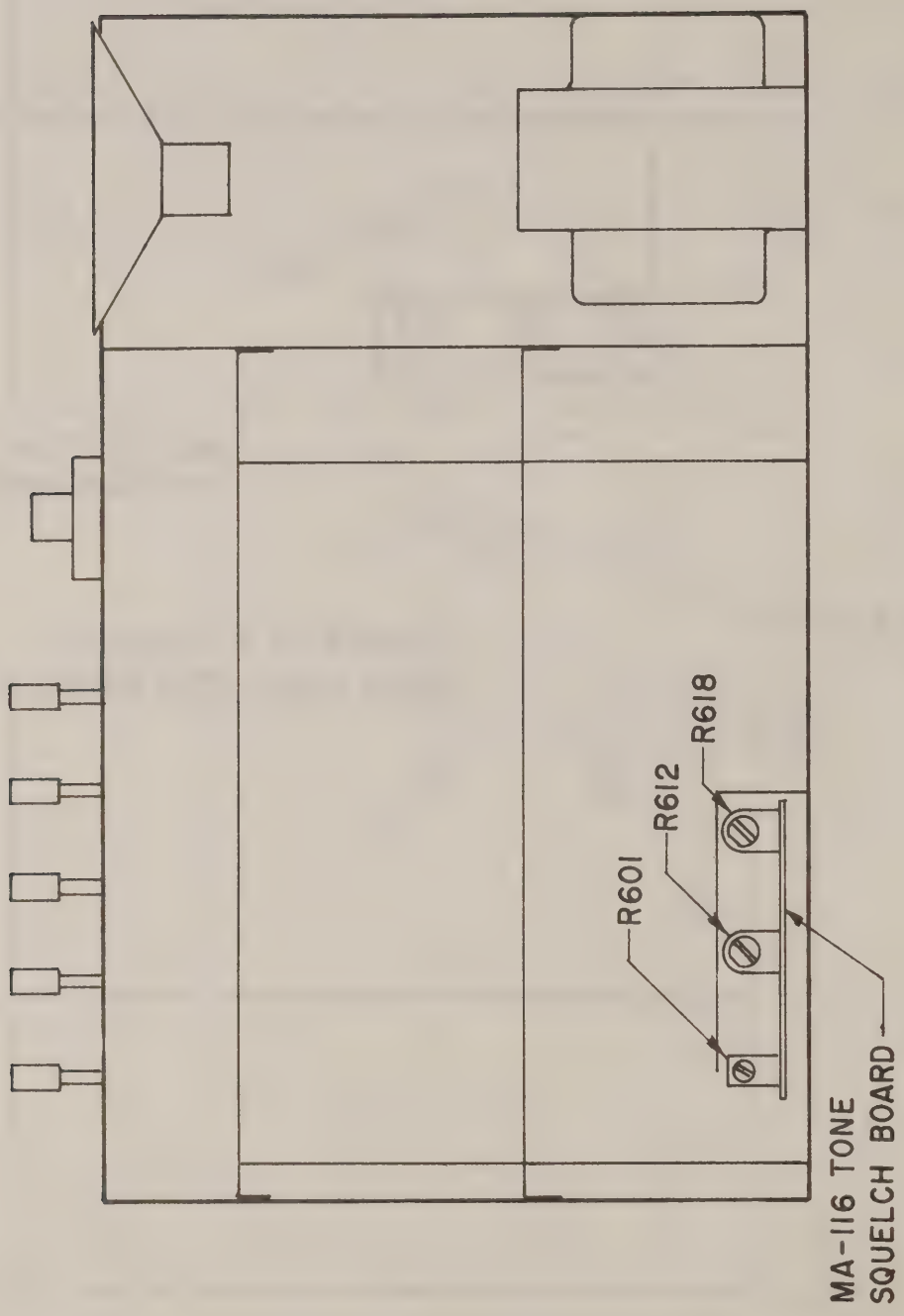


FIG 3

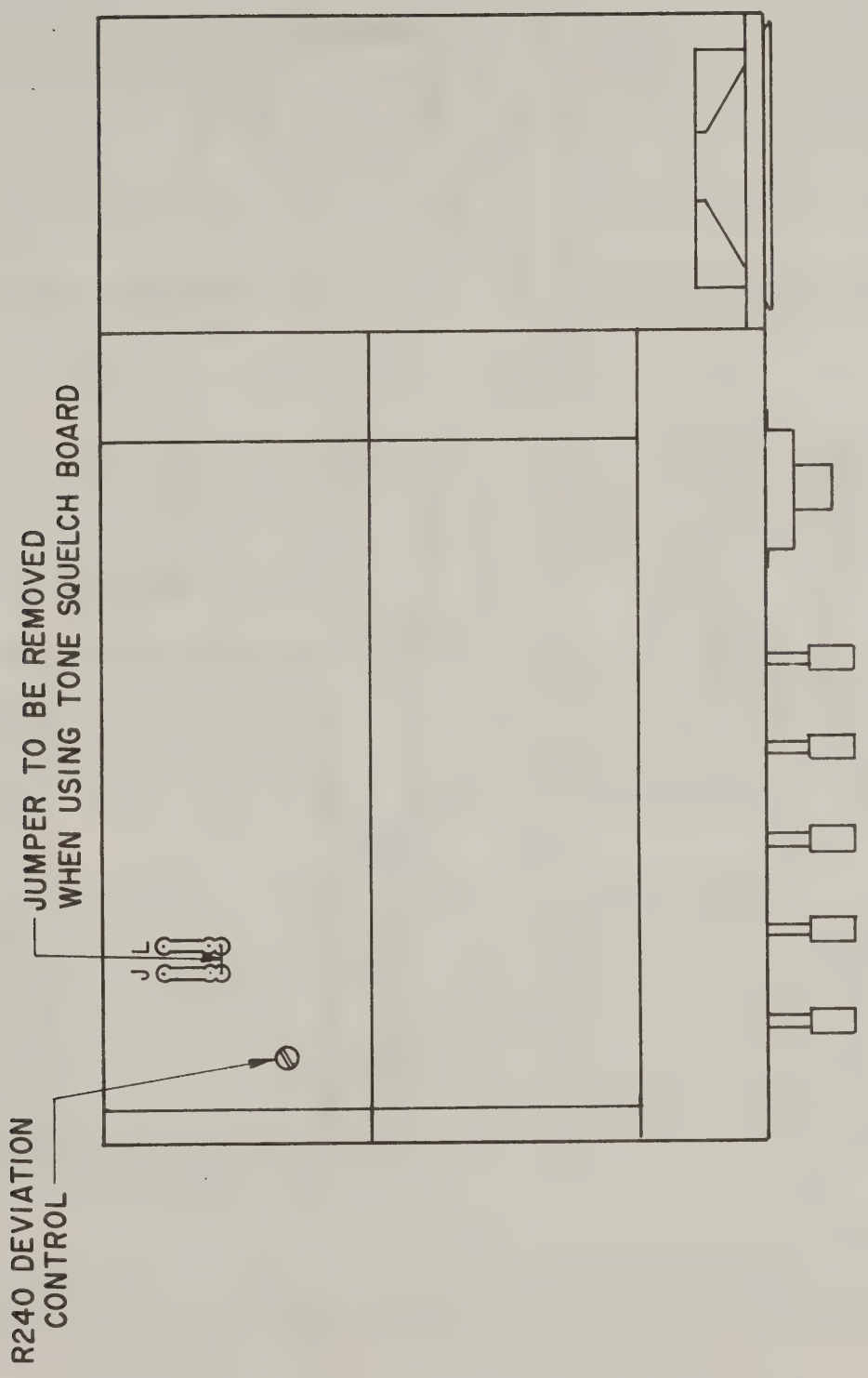

JUMPER TO BE REMOVED
WHEN USING TONE SQUELCH BOARD
J L
R240 DEVIATION
CONTROL

FIG 4

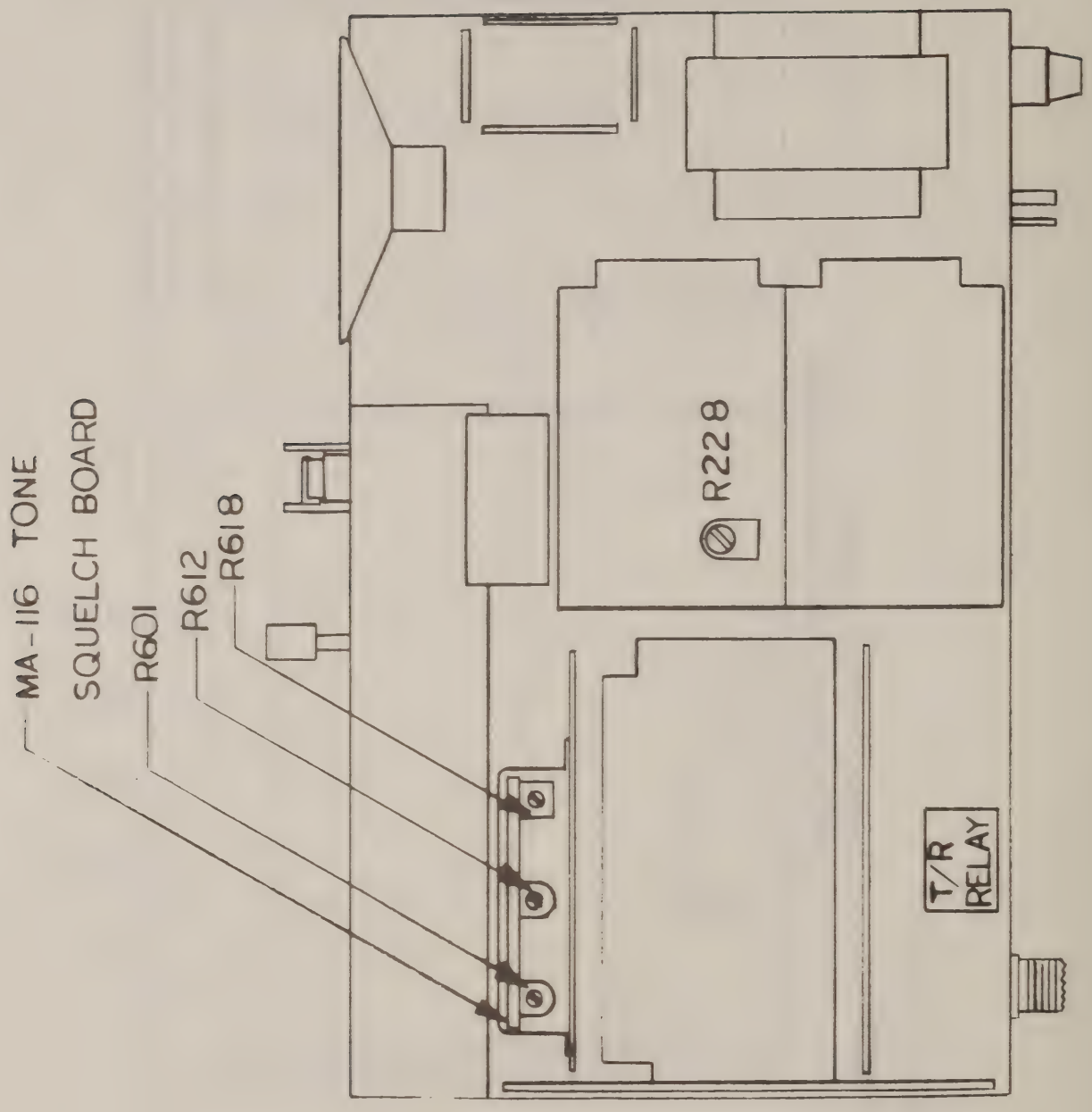


FIG. 5

MA-116 TONE SQUELCH (CTCSS) OPTION

A. GENERAL DESCRIPTION

The Model MA-116 Tone Squelch System is supplied as a factory installed, or field installed option for a variety of Regency transceivers. This option equips the radio for operation on systems using Continuous Tone Controlled Squelch Systems (CTCSS).

The circuit elements of the MA-116 tone squelch system are mounted on a plug in printed circuit board.

A block diagram of the tone system is shown in Figure 6, and a full schematic is shown in Figure 7.

B. CIRCUIT DESCRIPTION (Tone Receiving Condition)

Audio from the receiver discriminator is fed into the tone squelch board at terminal L, and passes through the High Pass Filter IC601A, and back to the receiver's audio amplifier circuits at terminal J. The high pass filter removes the CTCSS tones, which are below the normally utilized speech frequencies, so they will not be heard on the receiver loudspeaker.

Audio from the receiver discriminator (At L) is also fed into an active filter, consisting of IC601B, IC602A, and IC602B. This filter is a high Q, bandpass filter, that can be tuned for operation on any of the CTCSS tone frequencies. The components of the filter which determine the operating tone are precision resistors and condensers; R601, R602, R603, R604, R605, R606, R607, C601, and C602.

If the received tone is the proper one, as determined by the bandpass filter, it will be present in the output of IC602 and will be amplified by IC603, and then rectified to a D.C. signal by the tone rectifiers CR601 and CR602. This D.C. signal is then amplified further by the D.C. amplifier, IC603A. The output of IC603 is normally high, and goes to a low voltage upon receipt of proper tone. This output appears at terminal K, which connects to the corresponding terminal K on the receiver chassis, and is used to disable the receiver audio section when no tone is being detected.

C. TRANSMITTING AND MONITORING CONDITION

NOTE: Description defined here is for a typical mobile installation. In a typical base station installation the grounding or ungrounding of point U is accomplished with the monitor button on the desk microphone.

Both the block diagram and the full circuit diagram show a terminal point U, which is connected to the hang up button on the back of the microphone. When the radio is installed, the microphone hanger is connected to the chassis (ground) of the automobile, either

by being mounted on a metal portion of the vehicle, or by a suitable wire to the vehicle ground. When the microphone is in its hanger, point U is grounded; this is the normal "receive" condition of the tone squelch system. Operation of the system in the "receive" condition has been described above.

When the microphone is removed from the hanger, point U becomes ungrounded causing the base of Q601 to go positive. This causes the collector of Q601 to drop to a tenth of a volt or so, causing Q602 to be turned "off," removing the effective short circuit that the collector had been creating across the junction of R624 and R626. With this short removed, a feedback path around the bandpass filter, through IC603A, R626, and C607 created. This determined by its frequency determining elements. This oscillation output is amplified by IC503B to cause a low voltage at K, just as it would if it were receiving an incoming tone signal, permitting the audio system to operate.

Summarizing the above, when the microphone is off-hook, D is ungrounded, the bandpass filter begins to function as an oscillator, and pin K goes low, allowing the receiver to operate. During the time that the microphone is off-hook, and prior to the time that the microphone has been depressed for transmitting, the receiver will hear any signals on the channel regardless of whether or not they have the proper CTCSS tone. This is the "monitoring" condition of the radio.

The oscillation output of the bandpass filter is fed to F, and thus to the modulation section of the transmitter. When the transmitter is activated by pushing the microphone button, it is modulated by the CTCSS tone.

The amplitude of the tone voltage sent to the transmitter is controlled by R618, which is the control for adjusting the amount of modulation deviation caused by the tone. After the transmitter has been adjusted for proper modulation deviation on speech, according to the instructions given in the transmitter tuning procedure, R618 should be set to provide tone modulation deviation of plus and minus 500 Hz.

D. TONE SETTING INSTRUCTIONS

The tone frequency is determined by (a) the insertion of jumpers to determine which of three bands of operation is desired, and (b) the adjustment of a precision potentiometer to determine the specific tone frequency.

For purposes of installing the jumpers, the total CTCSS frequency is divided into three bands, the low band being 67.0 Hz to 110.9 Hz; the middle band 114.8 Hz to 192.4 Hz, and the high band 203.5 Hz to 253.0 Hz.

E. INSTALL JUMPERS FOR THE PROPER BAND

Figure 8 shows the jumper locations. Determine which band includes the desired frequency, and insert (or remove) jumpers according to the following chart:

67.0 Hz to 110.9 Hz	Low Band	JU601,JU602,JU603,JU604 are all removed.
114.8 Hz to 192.4 Hz	Middle Band	JU601,JU603 in place. JU602,JU604 removed.
203.5 Hz to 253.0 Hz	High Band	JU602,JU604 in place. JU601,JU603 removed.

After soldering or unsoldering jumpers, at least five minutes should elapse before making any final frequency adjustment. This is necessary to permit the precision resistors and capacitors in the vicinity of the soldering points to stabilize in temperature.

Final frequency adjustment may be made with the tone board installed in the radio, or it may be made prior to installation in the radio. If adjusted outside of the radio, connect a 13.8 volt source to the tone board, with the positive terminal going to point M and the negative terminal going to point E(gnd). If adjusted inside the radio, put the unit into the "monitor and transmit" condition by lifting the microphone off the hook. Turn the tone output potentiometer R618 fully clockwise and connect the tone measuring equipment to point F. Then carefully adjust precision potentiometer R601 to obtain the wanted tone frequency. Turning R601 clockwise increases frequency.

F. TONE SETTING PRECAUTIONS

Accurate frequency setting is necessary on CTCSS (tone squelch) systems. When making the above frequency adjustments, be sure that you set the tone as precisely as possible. If the tone board is to operate on a system using reed type tone boards, be sure that your frequency setting is within .1 or .2 Hz if possible. Especially on reed tone systems, it is advisable to measure the tone frequency of several of the existing units; it is not safe to assume that the system is really operating on exactly the frequency stamped on the nameplates.

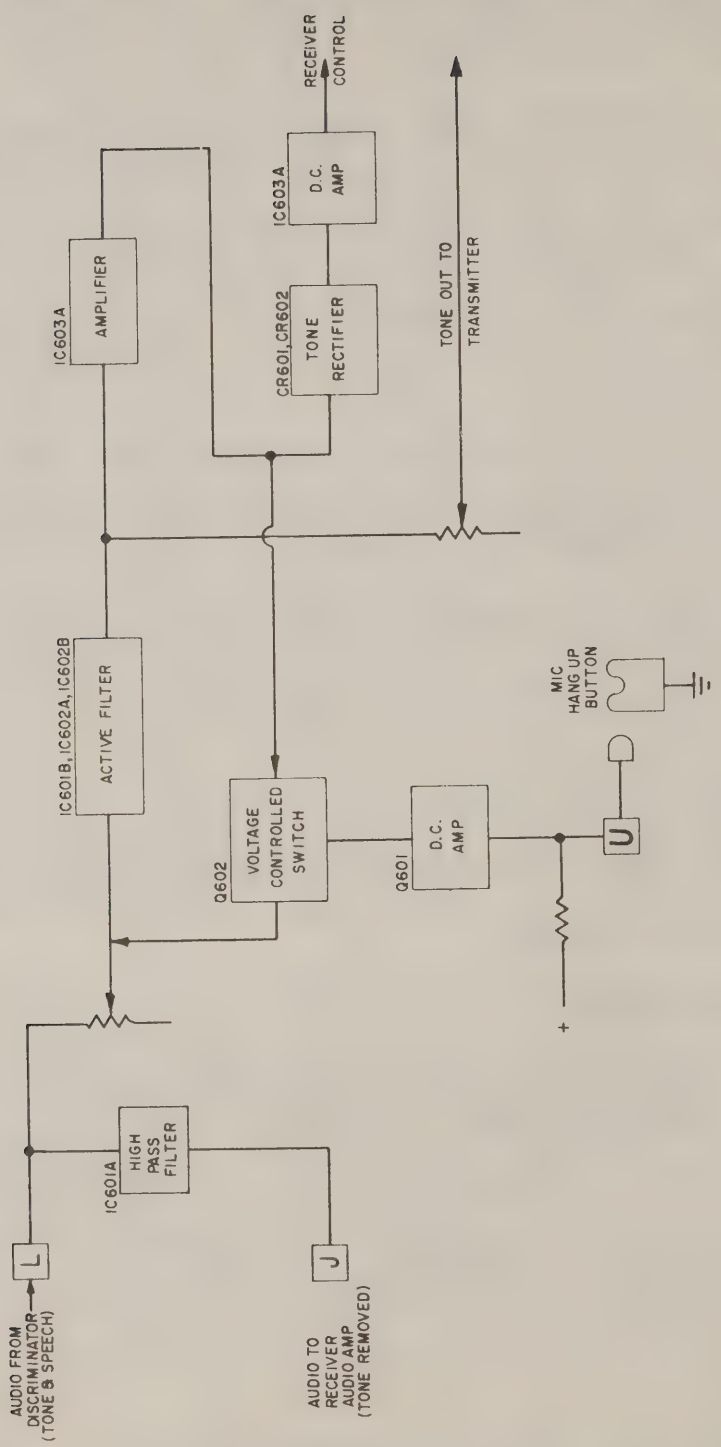


FIG 6 BLOCK DIAGRAM

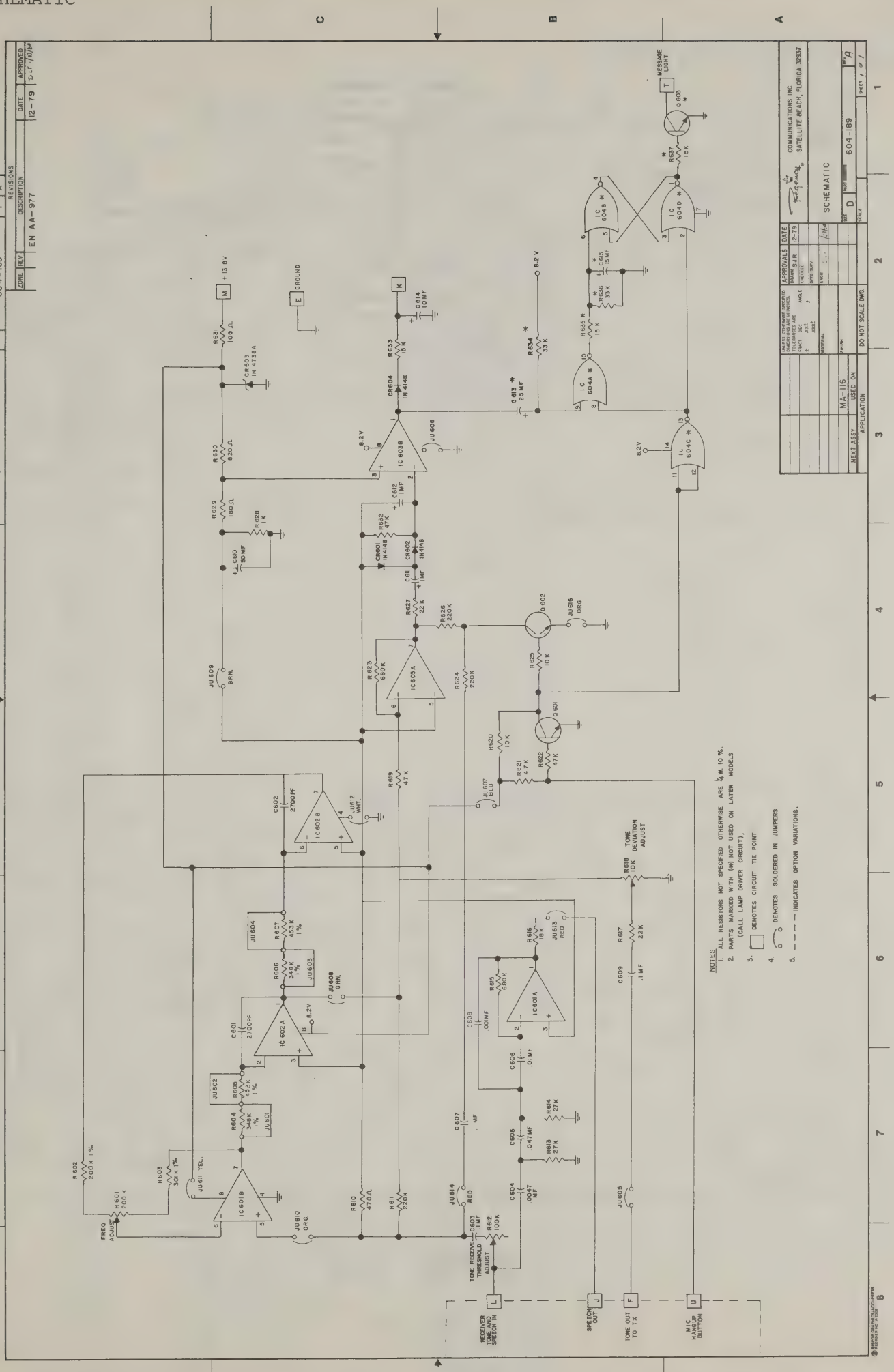
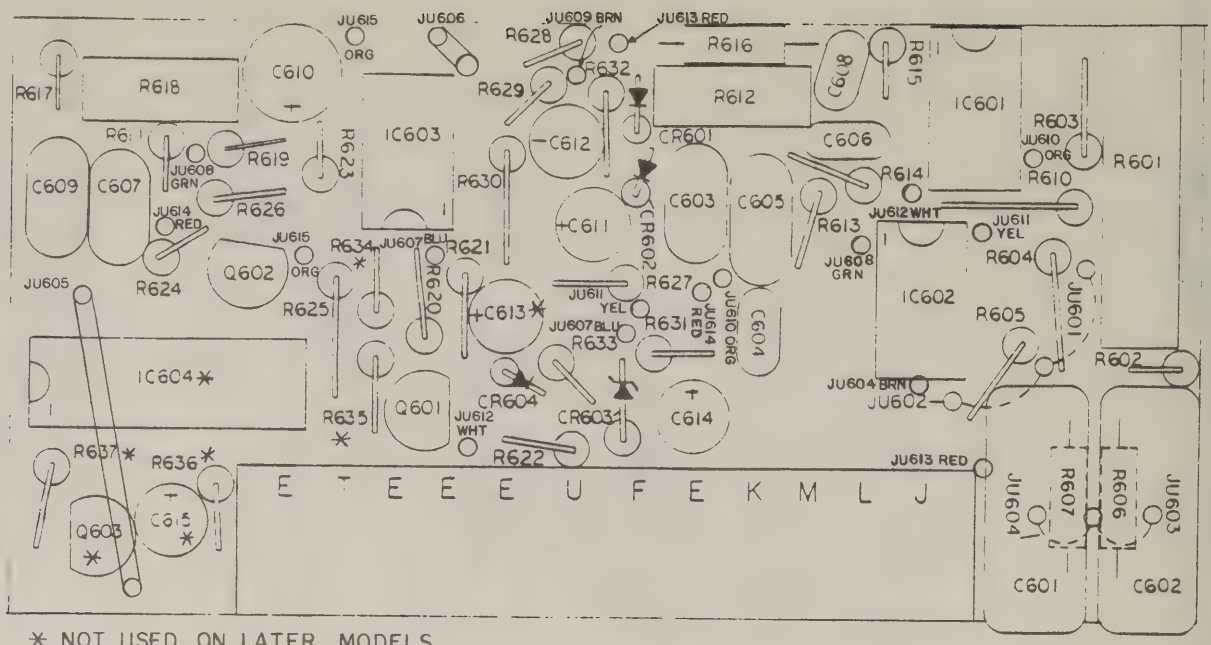
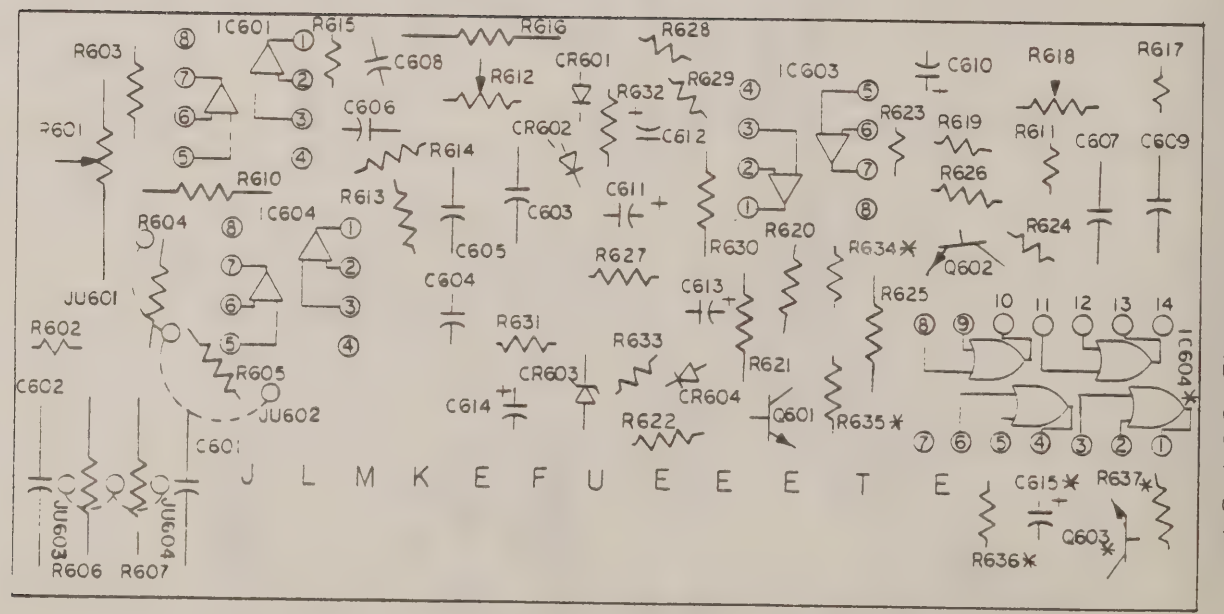


FIG 7 SCHEMATIC



TOP VIEW



BOTTOM VIEW

FIG 8

MA-116 PARTS LIST

	Resistors	Part No.
R601	200K Var	4751-0204-007
R602	200K	4709-3402-401
R603	301K	4709-3402-402
R604	348K	4709-3402-403
R605	453K	4709-3402-404
R606	348K	4709-3402-403
R607	453K	4709-3402-404
R610	470ohm 1/4W 10%	4701-0471-042
R611	220K 1/4W 10%	4701-0224-042
R612	100K Var	4751-0104-002
R613	27K 1/4W 10%	4701-0273-042
R614	27K 1/4W 10%	4701-0273-042
R615	680K 1/4W 10%	4701-0684-042
R616	18K 1/4W 10%	4701-0183-042
R617	22K 1/4W 10%	4701-0223-042
R618	10K Var	4751-0103-002
R619	47K	4701-0473-042
R620	10K 1/4W 10%	4701-0103-042
R621	4.7K 1/4W 10%	4701-0472-042
R622	18K 1/4W 10%	4701-0183-042
R623	680K 1/4W 10%	4701-0684-042
R624	220K 1/4W 10%	4701-0224-042
R625	10K 1/4W 10%	4701-0103-042
R626	220K 1/4W 10%	4701-0224-042
R627	22K 1/4W 10%	4701-0223-042
R628	1K 1/4W 10%	4701-0102-042
R629	180Ω 1/4W 10%	4701-0181-042
R630	820Ω 1/4W 10%	4701-0821-042
R631	100Ω 1/4W 10%	4701-0101-042
R632	47K 1/4W 10%	4701-0473-042
R633	15K 1/4W 10%	4701-0153-042
*R634	33K 1/4W 10%	4701-0333-042
*R635	15K 1/4W 10%	4701-0153-042
*R636	33K 1/4W 10%	4701-0333-042
*R637	15K 1/4W 10%	4701-0153-042

	Capacitors	
C601	2700 PF 5% 500V	1504-0272-505
C602	2700 PF 5% 500V	1504-0272-505
C603	.1 MF 20% 12V	1502-0104-005
C604	.0047 MF 10% 100V	1508-0472-610
C605	.047 MF 10% 100V	1508-0473-610
C606	.01 MF 10% 100V	1508-0103-610
C607	.1 MF 20% 12V	1502-0104-005
C608	.001 MF 10% 100V	1508-0102-610
C609	.1 MF 20% 12V	1502-0104-005
C610	50 MF 10V 85D	1513-0500-001
C611	1 MF 16V 85D	1513-0010-002

	Capacitors	Part No.
C612	1 MF 16V 85D	1513-0010-002
*C613	25 MF 10V 85D	1513-0250-001
C614	10 MF 16V 85D	1513-0100-001
*C615	15 MF 16V 85D	1513-0150-002

	Integrated Circuits	
IC601	TL082/LF353	3130-3167-912
IC602	TL082/LF353	3130-3167-912
IC603	LM358N	3130-3167-909
* IC604	MM74C02N	3130-3157-621

	Diodes	
CR601	SIL 1N4148	4805-1241-200
CR602	SIL 1N4148	4805-1241-200
CR603	ZENER 8.2V 1N4738A	4808-0000-009
CR604	SIL 1N4148	4805-1241-200

	Transistors	
Q601	SPS952	4801-0000-010
Q602	SPS952	4801-0000-010
* Q603	SPS952	4801-0000-010

*Not used on later models

MA-116 ADDENDUM MANUAL

P.C. BOARD, REV. C

A. GENERAL

The MA-116 (P.C. Board, Rev. C) CTCSS Encoder/Decoder is intended for installation in all transceiver models that previously used the MA-116. Also it can be used in the MCCU10R repeater. It is advised that the tone/control board in the MCU10R be modified as per Service Bulletin No. 80-167 and the MA-116 Rev. C board be plugged into the first tone position (P706).

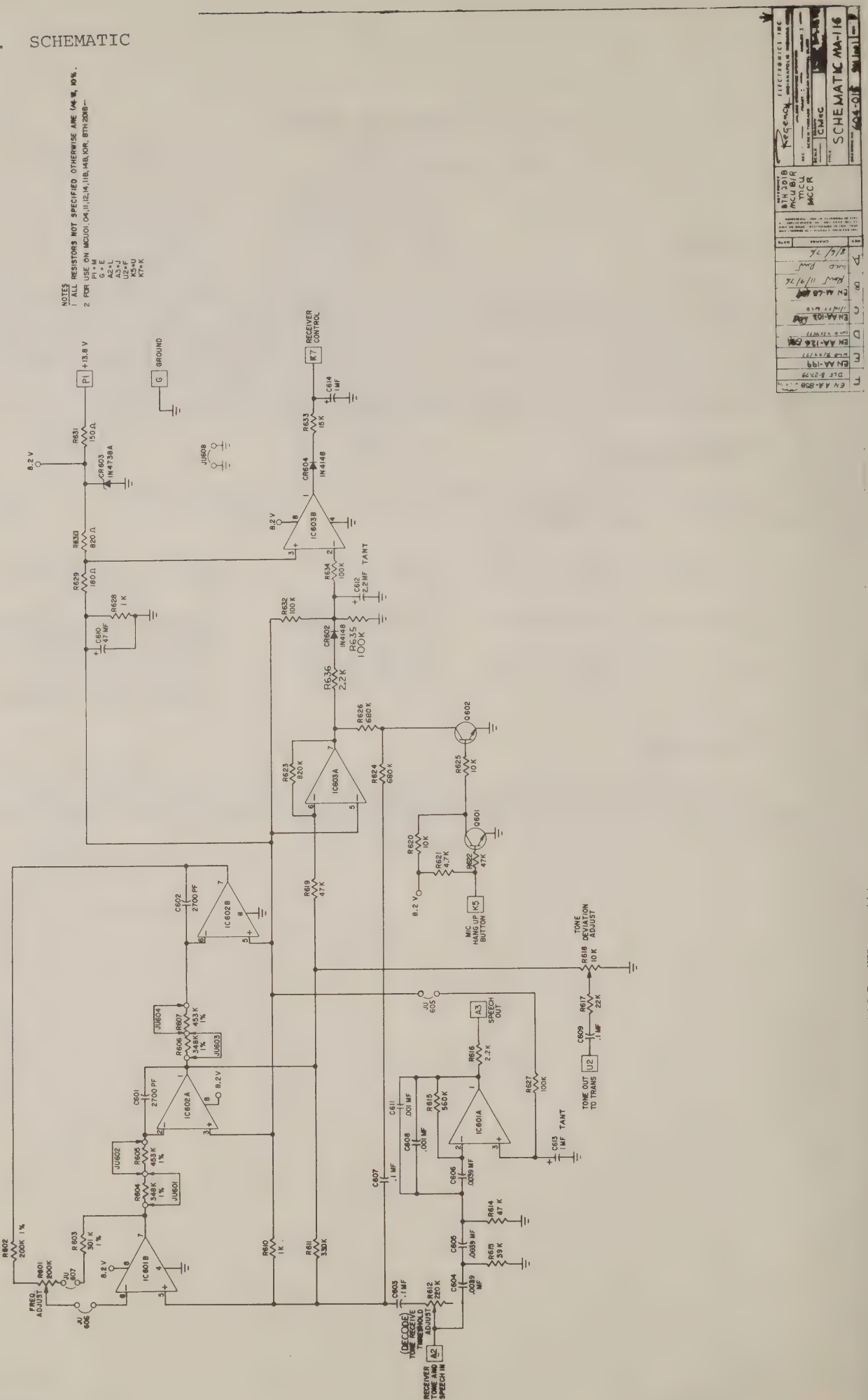
B. INSTALLATION

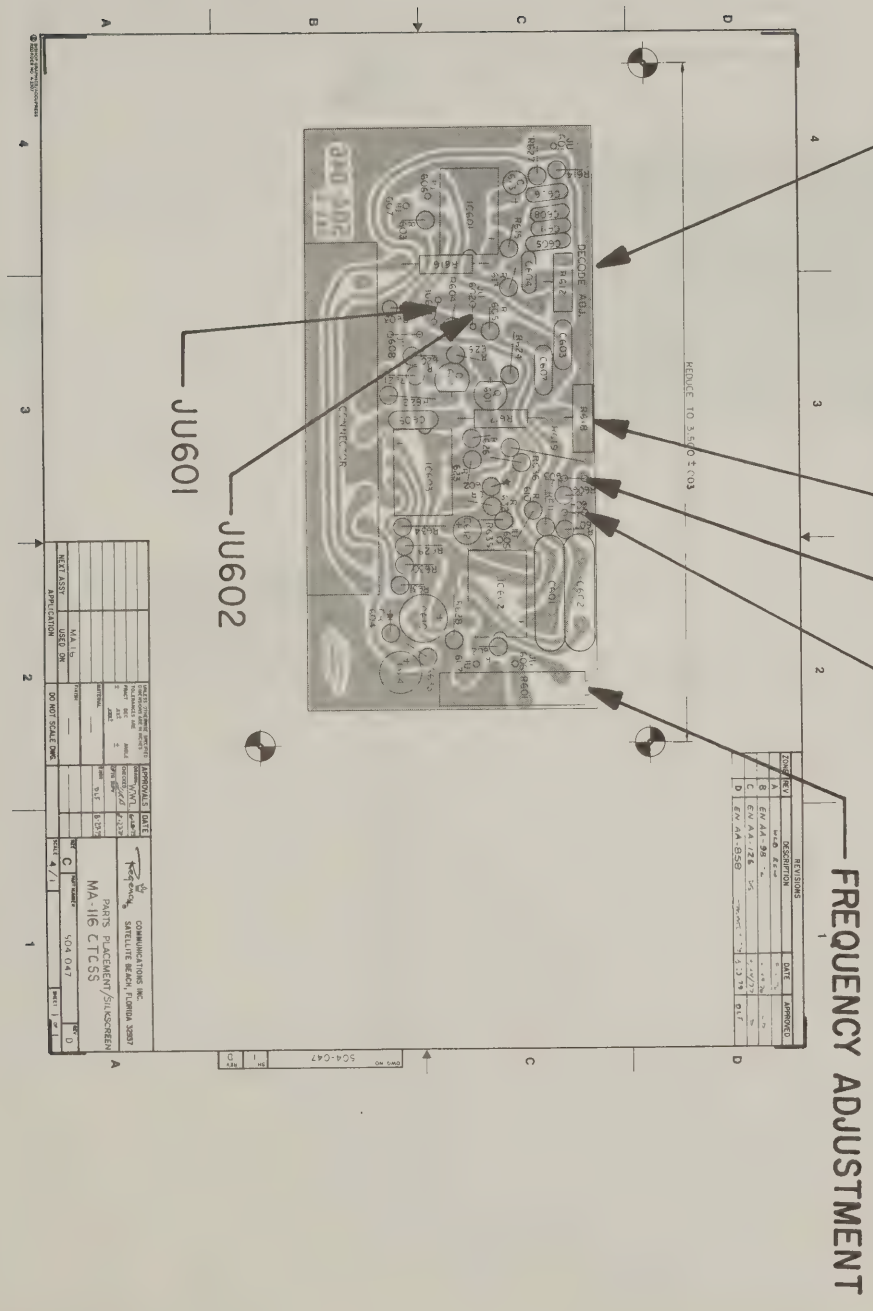
Installation instructions remain the same except for jumper positions. See Figure 1.

67.0 Hz to 110.9 Hz	Low Band	JU601,602,603,604 all removed
114.8 Hz to 192.4 Hz	Middle Band	JU601,603 in place JU602,604 removed
203.5 Hz to 253.0 Hz	High Band	JU602,604 in place JU601,603 removed

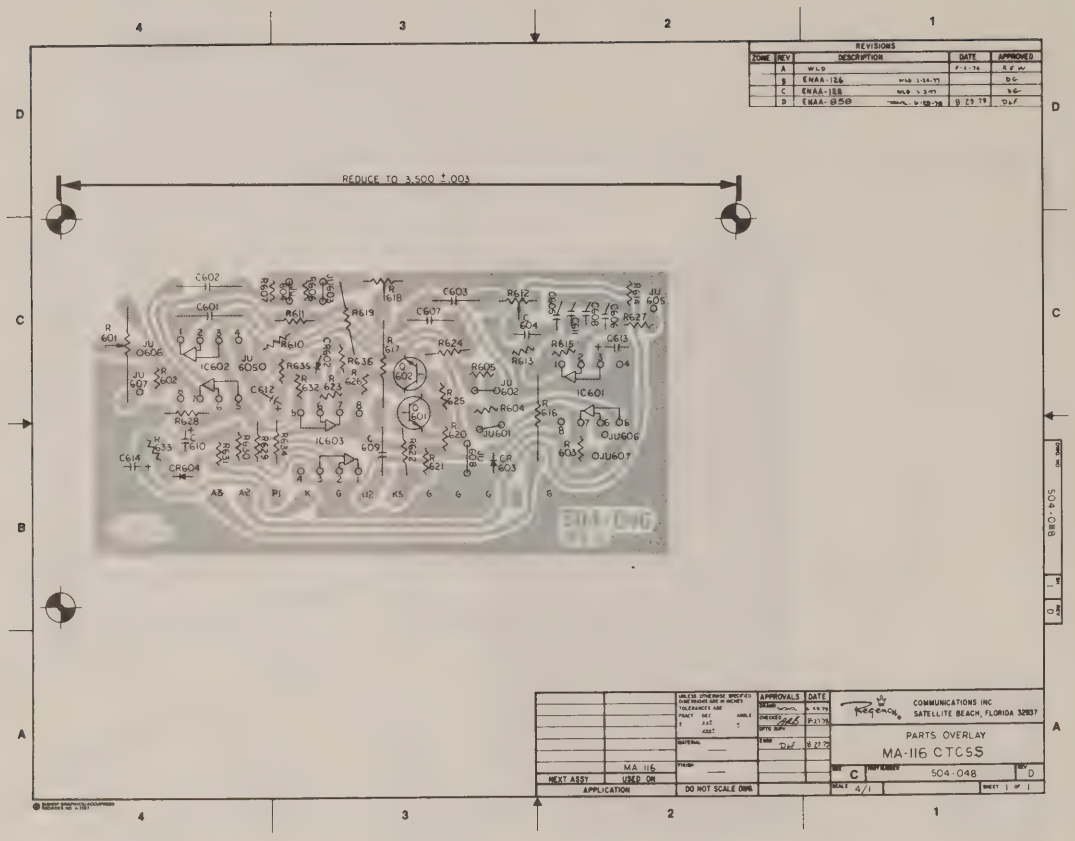
C. ADJUSTMENT

Adjustment instructions remain the same except for the positions of R612 and R618 (decode and encode level) are reversed. See Figure 1.


NOTES
1 ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 W, 10%.
2 FOR USE ON MICU01: 04,11,12,14,118,148, IOR, 8TH 2018-
P1 = M
G = E
A2 = L
A3 = J
U2 = F
K5 = U
K7 = K
SCHEMATIC MA-116
604-018
RECEIVER CONTROL
GROUND
+13.8 V
8.2 V
IC603B
IC603A
IC602B
IC602A
IC601B
IC601A
Q602
Q601
MIC HANG UP BUTTON
TONE DEVIATION ADJUST
SPEECH OUT
TONE OUT TO TRANS
FREQ. ADJUST
(DECODE) TONE RECEIVE THRESHOLD ADJUST
RECEIVER TONE AND SPEECH IN


DECODE ADJUSTMENT
ENCODE ADJUSTMENT
JU603
JU604
FREQUENCY ADJUSTMENT
JU601
JU602

F. PARTS OVERLAY



MA-116 ADDENDUM MANUAL

P.C. BOARD, REV. C

PARTS LIST

LOCATION	DESCRIPTION	PART NUMBER
RESISTORS	(all resistors are ¼W 5% unless otherwise noted)	
R601	200K var	4751-0204-007
R602	200K	4709-3402-401
R603	301K	4709-3402-402
R604	348K	4709-3402-403
R605	453K	4709-3402-404
R606	348K	4704-3402-403
R607	453K	4709-3402-404
R608	not used	
R609	not used	
R610	1K	4704-0102-032
R611	330K	4704-0334-032
R612	220K var	4751-0224-002
R613	39K	4704-0393-032
R614	47K	4704-0473-032
R615	560K	4704-0564-032
R616	2.2K	4704-0222-032
R617	22K	4704-0223-032
R618	10K var	4751-0103-002
R619	47K	4704-0473-032
R620	10K	4704-0103-032
R621	4.7K	4704-0472-032
R622	47K	4704-0473-032
R623	820K	4704-0824-032
R624	680K	4704-0684-032
R625	10K	4704-0103-032
R626	680K	4704-0684-032
R627	100K	4704-0104-032
R628	1K	4704-0102-032
R629	180	4704-0181-032
R630	820	4704-0821-032
R631	150	4700-0151-042
R632	100K	4704-0104-032
R633	15K	4704-0153-032
R634	100K	4704-0104-032
R635	100K	4704-0104-032
R636	2.2K	4704-0222-032
CAPACITORS		
C601	2700pf 5%	1504-0272-505
C602	2700pf 5%	1504-0272-505
C603	.1mf 12V	1502-0104-006
C604	.0039mf 5%	1508-0392-510

LOCATION	DESCRIPTION	PART NUMBER
C605	.0039mf 5%	1508-0392-510
C606	.0039mf 5%	1508-0392-510
C607	.1mf 12V	1502-0104-006
C608	.001mf 5%	1508-0102-510
C609	.1mf 12V	1502-0104-006
C610	47mf 10V	1513-0470-001
C611	.001mf 5%	1508-0102-510
C612	2.2mf tant	1515-0229-005
C613	1mf tant	1515-0010-003
C614	1mf	1513-0010-004
INTEGRATED CIRCUITS		
IC601	TL-082/LF353N	3130-3167-912
IC602	TL-082/LF353N	3130-3167-912
IC603	LM358N	3130-3167-909
DIODES		
CR601	not used	
CR602	IN4148	4805-1241-200
CR603	IN4738A	4808-0000-009
CR604	IN4148	4805-1241-200
TRANSISTORS		
Q601	SPS-952	4801-0000-010
Q602	SPS-952	4801-0000-010